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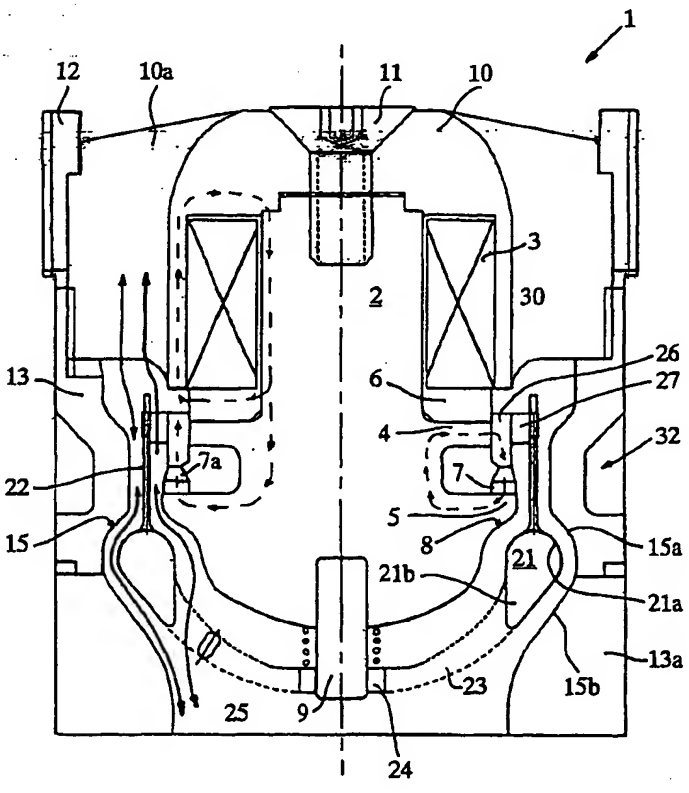
[Continued on next page]

(54) Title: ANNULAR VALVE



(57) Abstract: A valve assembly (1) operable to allow or prevent the flow of fluid to or from a working chamber of a fluid-operated machine, comprising radially spaced apart inner and outer annular valve seats (8, 15) defining an annular passage therebetween, a valve member comprising a sealing ring (21), and means (3, 7, 26, 25) for moving the valve member axially between a first position in which the sealing ring (21) is in seating engagement with the annular valve seats to close the annular passage to fluid flow therethrough and a second position in which the sealing ring (21) is spaced from the annular valve seats (8, 15) so that the annular passage is open to fluid flow therethrough. The valve assembly further comprises axially spaced apart first and second valve guide means (6) for guiding the valve member during axial movement between its first and second positions.

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Declaration under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

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INTERNATIONAL SEARCH REPORT

PCT/GB 02/05685

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16K15/08 F16K31/06 F16K31/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 84 25 037 U (MANNESMANN AG) 22 August 1985 (1985-08-22) page 3, line 18 -page 4, line 20; figure	1,2,4, 6-11
A	GB 1 104 308 A (RATELBAND JOHANNES B) 21 February 1968 (1968-02-21) cited in the application page 1, line 42 -page 2, line 3; figure	1,2,10, 11
A	US 3 845 782 A (GEE D ET AL) 5 November 1974 (1974-11-05) abstract	1,15
A	DE 503 771 C (HOERBIGER & CO) 26 July 1930 (1930-07-26) page 1, line 1 - line 7 page 1, line 38 -page 2, line 21; figures 1-5	1-4,15

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 June 2003	25 06 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Christensen, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

PCT/GB 02/05685

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 441 679 A (CHALICH DANIEL) 15 August 1995 (1995-08-15) abstract	1,10
X	NL 60 448 C (MACHINEFABRIEK GEBR. STORK) 15 August 1947 (1947-08-15) figure 1	12,13

INTERNATIONAL SEARCH REPORT

PCT/GB 02/05685

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

1-4,6-15

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-4,10,11,15

Annular valve with guide means:

The technical features of claim 1:

Valve assembly with:

a1) a sealing ring
a2) inner and outer annular valve seats
a3) means for moving the sealing ring axially between open and closed position
a4) first guide means
a5) second guide means axially spaced from the first guide means

2. Claims: 5,10,11,15

Annular valve with electromagnetic actuation means:

The technical features of claim 5:

Valve assembly with:

a1) a sealing ring
a2) inner and outer annular valve seats
a3) means for moving the sealing ring axially between open and closed position
b1)ferrous annular moving pole member attached to the valve member
b2) permanent magnet urging the pole member so that the valve member is in an open position
b3) coil means which when energised oppose the magnetic ~~force of the permanent magnet to move the valve to the~~ closed position

3. Claims: 6-11,15

Properties of the valve seats for an annular valve:

Technical features of claim 6 are:

Valve assembly with:

a1) a sealing ring
a2) inner and outer annular valve seats
~~a3) means for moving the sealing ring axially between open~~ and closed position
c1) the inner and outer valve seat are constructed and

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

arranged to have substantially the same elasticity

4. Claims: 12-15

Annular valve with special shape of flow passage:

Valve assembly with:

a1) a sealing ring
a2) inner and outer annular valve seats
a3) means for moving the sealing ring axially between open and closed position
d1) the outer valve seat converges rearwardly form the valve seat
d2) the diameter of the rearwardly portion is smaller the the diameter of the outer valve seat

INTERNATIONAL SEARCH REPORT

PCT/GB 02/05685

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